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Getting Sustainable Development into the Curriculum

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ABSTRACT

Industry and government are in agreement that students graduating from higher education need to be more aware of social, ethical, and cultural issues prior to entering the workforce [1, 2]. The UK government is particularly vocal in its belief that undergraduates should graduate with a good understanding of sustainable development issues [2]. Finding a way to include additional and complex content into a heavily timetabled computer science undergraduate degree programme is difficult. Within Durham a Sustainable Development Workshop, that takes the form of a competition between tutorial groups, has been developed as a means to introduce the subject into the curriculum. This paper provides details of, and reflections on, our first attempt at this workshop and outlines our planned changes for next year.

Keywords

Sustainable Development, Ethics, Workshop, Tutorial.

1. BACKGROUND

1.1 Sustainable Development

The Higher Education Funding Council of England (HEFCE) has recently striven to promote the inclusion of Sustainable Development (SD) in all Higher Education curricula [2]. Educators have long struggled to get students to participate in subjects that students consider to be outside the scope of their course. It is unlikely, therefore, that any experienced practitioner is not aware of the challenges that HEFCE is posing for the community. This paper provides a case study investigating if SD can be included in the Computing curriculum in a way that engages students.

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SD is the phrase used when government agencies and business talk about protecting the planet's natural resources and growing developing world economies while maintaining the vibrant economies of countries in the developed world [3, 4, 5]. Essentially it is about saving the planet and the people who live on it. SD can affect all areas of our lives, from the type of coffee we buy to how industries are regulated. It is obvious that the complexities of SD are too large to be added to the Computing curriculum but that does not mean that we cannot get students to examine how their chosen discipline will impact the world around them.

A significant number of students are aware of socio-economic and ethical issues. They may be involved in local schemes to help improve the environment in their own neighbourhoods or prefer to support global campaigns such as 'Make Poverty History' [6]. But they see this involvement as outside their degree and view their degree programmes as isolated from the world. By weaving ethical and global issues such as SD into the existing curriculum, we have endeavoured to encourage students to discover the impact of their discipline on the world and the world's impact on their discipline.

1.2 Integrating SD into the curriculum

The 2005/06 second year cohort for Computer Science comprised 53 single honours students and 6 Natural Sciences students. A typical second year student will have achieved an acceptable (or better) level of competency in programming, discrete mathematics, logic and the fundamentals of distributed computing in their first year at Durham. Combined with this, will have been success in one or two modules offered by other departments to first year undergraduates at Durham. Physics and Mathematics modules have always been popular with Computer Science students but, so too, have languages, Business Studies, and Philosophy.

At the beginning of each academic year the second year cohort is divided into groups of between four and seven students, thus forming their tutorial group

for that year. In addition, in the second year there is a large group project (the Software Engineering Group – or SEG – project) [7]. The success of this project requires good communication between its members. The same group structure is maintained for the tutorials and for the group-work project. The department has found that the significant length of time that students spend working on this project means that the members of the group get to know each other well and, therefore, this cohesiveness assists the smooth running of tutorial sessions.

Tutorials provide small groups of students with the opportunity to work through one or more well designed activities, usually based on problem-solving, while interacting with peers and academic staff. Good tutorials provide an active learning environment [8] where all students are given the chance to participate [9]. At least partly contributing to the success of the group structure, are the team building activities that are arranged for the group work. Students enjoy this work and actively participate in all the different activities. Unfortunately such enthusiastic participation is not maintained in the more traditional tutorial sessions. We decided that, with a difficult topic such as SD, the traditional tutorial approach would not serve its purpose and, therefore, sought to format a tutorial session using the same format that the group work team building activities had used to engage the student population. The concept of an SD workshop was, therefore, conceived.

2. THE SD WORKSHOP

The basis of the workshop was a scenario where a local government competition was proposed to encourage companies to develop an SD policy. The students used the workshop to construct and present their policy and a prize was awarded to the company with the best SD policy. The SD workshop was organised as a role play exercise where tutorial groups competed against one another in the workshop.

Normally the time taken for a tutorial is approximately an hour. For something as large and busy as the SD workshop, we required at least three consecutive hours of staff and student time. It would have been possible to divide the workshop into three separate sessions based on the tasks outlined later in this paper. However, running the SD workshop for three hours early in the academic year ensured that it did not clash with any summative work deadlines. Furthermore, we believe the continuous activity of a three hour workshop contributed to the fun nature of the work which helped to gel the tutorial group structure.

2.1 Academic Staff as Facilitators

During the SD workshop, academic staff assumed the role of facilitator and interacted with two or three groups throughout the workshop. There were 9 facilitators giving us a 1 to 7 (staff to student) ratio. The group of facilitators consisted of: six of the seven lecturers for the second year Software Engineering module; the postgraduate demonstrator who would be working with the groups in the Software Engineering module labs; and two members of the Active Learning in Computing research project. These latter would be participating, occasionally, in teaching activities associated with the Software Engineering Group project. Only two of the facilitators were known to most of the cohort prior to the start of the second year as only two of them had lecturing responsibilities in the first year undergraduate course. The team building activities in the second week of term would have been the first time the students would have seen the other members of staff. The team building activities together with the SD workshop provided staff and students with the opportunity to get to know each other before meeting in the more formal learning environments of the lecture theatre and tutorial seminar rooms.

The facilitator's role was, essentially, to move things along. The facilitators answered questions concerning SD and specific roles that students were not familiar with such as Head of Estates and Building, and ensured that quieter students did not get left out of discussions. Facilitators, particularly those relatively new to the students, were pro-active in engaging with students and made themselves known to students quickly.

In addition, facilitators observed the students to provide feedback about the success or failure of the workshop at a staff meeting at the conclusion of the workshop. As this was our first attempt at this type of workshop, facilitators had little idea of what to observe and report prior to the workshop's taking place. The only instructions given to facilitators prior to the workshop were to aim to have all students participating as fully as possible.

2.2 How the SD Workshop Operated

The workshop began with a short, five minute, introduction that included a description of the afternoon's activities and the learning objectives for the workshop. Each group was presented with the workshop support materials consisting of:

- details of the scenario on which the role play was based;
- the list of timed tasks together with a description of what was the expected output for each of the tasks; and
- an information pack about SD.

2.2.1 The Scenario

The scenario used for the SD workshop was based on a competition where a local government organisation is offering a prize to a 'company' that can best show that they are promoting SD. In this scenario the company's Board of Directors have decided that they wish to enter the company with the aim of winning the competition to provide the company with good publicity.

To encourage all members of the tutorial group to participate, the scenario goes on to say that "The company's Board of Directors have decided that the strategy offering the best chance of winning would be to apply a cross-departmental approach. They have, therefore, tasked each Department Head to identify how they will improve sustainability within their divisions." Each tutorial group needs a member of their group to play one of the following 'Department Head' roles: Director of Estates and Buildings, Head of Purchase Management, Head of Software Development, Head of Advertising, Director of Human Resources, Head of IT Networking and Hardware Support.

Each Senior Management team was required to create their company's SD strategy and to present that strategy at a competition for the Local Government award. Of course, for a company to win the award they must have a good understanding of SD and its impact on business, and have prepared a good presentation.

The results of running the workshop in 2005/6 showed that it took most tutorial groups less than ten minutes to read the scenario, allocate roles, read the list of tasks and skim the content of the Information Pack. Once that was done, they moved on to the various tasks that had been set for them.

2.2.2 The Tasks

2.2.2.1 Task 1 Initial exploration of ideas

Students assumed the role of whichever department head they had chosen and explored the content of the Information Pack. Then they derived a range of ideas for their own department to improve their company's promotion of SD. During this task the facilitators moved amongst the different groups giving short answers to questions regarding the SD and the workshop in general. Here facilitators needed to ensure everyone was getting started. This task was allotted ten minutes but actually took about fifteen minutes.

2.2.2.2 Task 2: Brainstorming and Presentation Preparation

As a group, the students brainstormed all their different ideas and usually discovered new ones.

Students were instructed to confine the number of ideas selected for their presentation to a number that they would be comfortable presenting in the four minute presentation slot. Some groups arrived at a substantial number of ideas and had to narrow down the number of ideas using persuasion and negotiation.

The facilitators' role during this task was one of trouble maker. The facilitator encouraged students to "let their imaginations fly". When some groups started to narrow down ideas early in the brainstorming activity it was the facilitators' responsibility to encourage the group to give the topic broader consideration. In addition, facilitators were required to stir-up arguments within the group, for example telling the Head of Purchase Management that it would be very expensive to buy all this environmentally friendly equipment which the Head of Software Development was insisting the company should buy. Facilitators asked "Are you sure you want to go along with something that will consume the purchasing department's budget and only benefit the Software Development department's reputation?" In other words, students were advised to fight for their 'department' and their ideas.

Once the groups reached a consensus they were required to create a poster in the form of a single PowerPoint slide that would be projected onto a large screen during the groups' presentations. Students were also advised by facilitators to take some time to plan their presentation.

2.2.2.3 Task 3: Presentation and Voting

The group presentations given at the end of the workshop took about an hour and fifteen minutes to cover twelve groups. Each tutorial group was allowed four minutes to present their ideas with their slide displayed on a screen where everyone in the room could see it. The four minute rule was rigorously enforced and required cutting some presentations off before they had finished. Students introduced themselves and included their role in their description of themselves. However, only a few students really assumed a persona for the presentation.

Student participation in the judging process was also an important aspect of the workshop. Each group was given an official ballot with their tutorial group's number printed clearly on the top. The facilitators, as a group, also completed a single ballot form. The voting was done 'Eurovision Song Contest' style.

For those unfamiliar with this event, the Eurovision Song Contest is an annual 'pop' musical contest whose final is televised across Europe to all participating countries. It is a kitsch event that has strong and faithful following in Europe. People have

been known to throw Eurovision-themed parties. Each participating country that has achieved the semi-finals or better is allowed to rank the final acts in order of preference. A country's preference is established by public phone-in votes. Residents of a country may vote for any finalist country except the country in which they reside. Points are awarded based on the ranking. The entry with the highest number of points, after all countries rankings are counted, wins and the country they represent has the honour of hosting the next year's event. A leader board is present during the voting process so that the cumulative effect of all the countries votes can be seen.

At the end of the SD presentations, each group completed its ballot by ranking the top six groups from the twelve that presented. In keeping with the 'Eurovision' theme no group was allowed to vote for their own team. The top ranked group was given 12 points, the second best given 10 points, and the third best 7 points and so on. Any group not mentioned on a ballot paper was given zero. A leader board was projected and facilitators went around the room to each group and read out the content of each group's ballot paper. As each group's votes were read out and recorded, the leader board was changed to reflect the new votes. As with Eurovision, there were calls of "Unfair", and a good deal of cheering and booing as the leader board changed. A bit of vote manipulation and politicking even went on as well. Everyone – including the facilitators - seemed to enjoy this part of the workshop. However, it took more time than the thirty minutes that had been allocated because we had only one person recording the votes. The process was also delayed by the facilitator group who had difficulty reaching a consensus on the point allocations for their ballot!

2.2.3 Information Pack

Unfortunately there was no Internet connection in the room where the workshop was held. It was, therefore, necessary to provide each group with an information pack that contained:

- a collection of short, single-paragraph definitions of SD sourced from a range of different organisations including the World Commission on Environment and Development, the UK Government and HEFCE; and
- a collection of articles from a variety of organisations including BBC News web site, Internet magazines, corporate or government brochures, and newspapers.

It should be noted that the articles were printed on coloured paper. Each article was copied onto a colour that was unique within the pack. Using paper of different colours served two purposes: firstly, it ensure that the documents were accessible for

students who have difficulty reading black text on a white background, students with Irlen-Syndrome [10] for instance; and, secondly, the different colours helped all students differentiate quickly between the articles.

3. RESULTS

3.1 Facilitators' Feedback

The facilitators had an informal meeting at the end of the event to discuss what they had observed during the workshop and any ideas on how to improve the next attempt at the workshop. We are a small department that know each other fairly well and can achieve successful outcomes from an informal meeting. As the facilitators were not given any idea about what to look for during the workshop, their observations, though useful, were unstructured.

Most facilitators thought that the workshop had gone well, that bonds within the groups had strengthened, and that students gained a reasonable understanding of SD. However, a number of the facilitators noticed that the students had not entered into the spirit of role play very quickly and had not adopted a role so much as given themselves a role title and then forgotten about it. We believe that this reduced some of the fun of the workshop. In addition, because they did not assume the roles, students also had difficulty identifying their group as a company. For example, most groups used their tutorial group number rather than dreaming-up a company name.

We believe that we should have emphasised the importance of the role play element of the exercise. We propose, next year, to supply groups with a company 'history' unique to each tutorial group and with the list of possible roles. The company 'histories' can be used to give students an indication of how to go about participating. For example, we could get them to decide on a name for the company at the start of the workshop. Here is an example of one such history:

"Your company is a small software game development house that has been in business for about two years. Up until now the range of software for sale has been games available for download from the company's web site. You have a loyal Internet customer base but have, as yet, to break into the main shopping markets (either in store or on-line). However, you have a new product nearly ready for release that the marketing people think can make it in the main markets against the big software developers. It is based on saving endangered species from evil poachers. Your marketing research indicates that your likely customer base for this product will be parents and children who are active in their concern about the

environment and ethically aware. You need, before the product release, to make a 'splash' that your potential customers will see."

One of the facilitators noticed that some groups of students were filtering ideas rather than developing them during the brainstorm activity. We believe that it may be helpful if students are given a fuller description of what a brainstorm activity is supposed to entail and produce. Next year, during the workshop introduction, more emphasis will be placed on the expected outcome of this activity. This will allow facilitators to concentrate on encouraging the brainstorming activity rather than putting all their effort into checking for and stopping the early filtering process that has occurred this year.

Now that we have participated in one workshop and reflected on the outcomes of the workshop, we have concluded that we need an evaluation strategy in place before we hold the next workshop. A proper evaluation strategy would help us to determine if the teaching and learning objectives of the workshop are being met. Observation by facilitators will play a key part in that evaluation strategy. We intended to have a facilitators' briefing prior to next year's workshop and this will include a discussion of what to look out for during the workshop. For example, we would want to know if the new company 'histories' have encouraged students to engage in more active role play. We also intend to nominate one member of staff to be an observer rather than a facilitator. This observer would be charged with gathering data that would allow us to compare the way in which groups work. This, combined with the observations made by facilitators who are interacting with the groups, should help us to evaluate the workshop.

3.2 Students' Feedback

During a Software Engineering lecture held in the week after the SD workshop, students were asked for a show of hands response if they agreed with three statements:

1. "The workshop helped me to get to know my team members." (75% agreement)
2. "I enjoyed the workshop." (27% agreement)
3. "I will continue to think about sustainability issues in the future." (23% agreement)

The results with the last two statements are discouraging. The location of the workshop in 2005/06 was in a room without Internet connection and students were not able to search for material that would reflect their understanding of the role play exercise, or their own past experience and personal interests. Instead, all groups were given the same set of materials discovered by us. We believe that, if

the students had been able to do some of their own research, they would have taken greater ownership of the knowledge and enjoyed the workshop more. To investigate this hypothesis next year, the SD workshop will be run in a room that provides wireless Internet connection as well as having a layout that will allow group work.

The actual means we chose to use to get the student feedback was not ideal. Students had no privacy and no opportunity to give a detailed opinion. In addition to the improvements to the way we get facilitator feedback, our new evaluation strategy will include the means for students to express their opinions privately. We intend to give the students individual questionnaires at the end the workshop. The questionnaire is likely to contain questions requiring either a yes/no or a sliding scale reply as well as to provide space for students to give more a more detailed reply if they wish. The actual content of the questionnaire is still being considered but, by collecting more focused feedback from the facilitators and better quality feedback from the students, we hope to have a better and more detailed evaluation on which to continue the evolution of the workshop.

4. CONCLUSION

This paper has presented a case study where SD issues can be introduced in a fun manner to the Computing curriculum. The format of the workshop encouraged students to think about these ethical issues in a wider context. The workshop promoted inclusion of all students. It included them as peer assessors to give them the opportunity to evaluate both their work and that of their peers. Unfortunately, the results of a student survey showed that they were not as positive as the staff thought they were after the session. The paper has highlighted a number of reasons why this may be the case and we will seek to correct the issues raised for next year. Despite the negative impressions from the students, the staff consider this to have been a good way of enacting the requirements of HEFCE within an already busy curriculum.

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